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time signals and wise typhoon warnings are of immense value to the units of the United States Asiatic Fleet, to army transports and in general to oversea shipping.

Meridian transits of stars are observed at the Manila Observatory with a Repsold transit instrument of 1913 pattern. The diameter of the objective is 7.5 cc. and its focal length about 80 cc.: the micrometer is provided with eleven fixed and three movable wires. Both Riefler clocks, sidereal and civil, keep an excellent rate. For the purpose of sending time signals, the transmitting clock of the Manila Observatory is connected with the Cavite Wireless Station thru the Bureau of Posts. Manila Observatory time signals begin at 10:55 A. M. and 9:55 P. M., standard time of the 120th meridian East of Greenwich; and continue for five minutes. During this interval every tick of the clock is transmitted, except the 28th, 29th, 54th, 55th, 56th, 57th, 58th and 59th of each minute. While the preliminary tests on the whole system of sending time signals by wireless were being conducted, I listened to the time signals myself on board the U. S. cruiser Wilmington, the U. S. moniter Monterey, the U. S. A. T. Sheridan and Merritt, and the Colombia of the Pacific Mail. It gave a special feeling of satisfaction to hear on board these vessels clearly and distinctly the ticks of the observatory pendulum. The high power Cañacao station pending completion, the radio transmission is by a 5 kw. spark set on a wave-length of 952 meters. I firmly believe that the day is not far off when every vessel plying between the North Pacific Coast and the Far East will be in a position to receive daily time signals by wireless, either from Mare Island or from Manila Observatory thru Cañacao Naval Station.

Manila Observatory. M. SELGA, S. J.

THE SPECTRUM AND RADIAL VELOCITY OF THE SPIRAL NEBULA N. G. C. 4151

One of Dr. Curtis's photographs with the Crossley reflector, tho taken for a different purpose, recorded the image of the nebula N. G. C. 4151 (R. A. = $12^h\ 5^m.5$, Dec. = $+39°\ 58'$) near one edge of the plate. The strong nucleus and the elliptic outline of a faint ring apparently symmetrical with reference to the nucleus suggested strongly that this object is in fact a planetary nebula. Its spectrum was accordingly observed visually by us in the expectation that we should find the well-known green nebular bright lines to be present. We found that the spectrum of the nucleus is a band of continuous light, upon which the two green bright lines of nebulium are superimposed. We were unable to decide from the visual observation whether the bright Hβ hydrogen line is present or not. We have photographed the spectrum of this object, using three-prism dispersion and a camera of six inches focal length, exposure 13 hours. The nebulium radiations 5007 and 4959A, and the Hβ radiations are the only features recorded. These radiations are not monochromatic; they form bands several angstrom units in width, and the centers of the three bands are displaced toward the red about 15 units from the normal positions of the corresponding nebular bright lines. The measures of the displacements indicate a radial velocity of recession amounting to 940 kilometers per second. The positions of the maxima of the three bands cannot be very accurately estimated and the assigned velocity may be in error by as much as 30 or 40 kilometers. The bands have about the average relative intensities found in the planetary nebulae, 10: 3: 1.

Dr. Curtis simultaneously secured a Crossley photograph with this object centered on the plate and the spiral structure is clearly evident.

The character of the spectrum resembles that of the spiral nebula N. G. C. 1068 (R. A. = $2^h\ 37^m.6$).

W. W. Campbell,
G. F. Paddock.

Note on the Motion in Some A Double Stars

Two earlier notes on the motion observed in some of the double stars discovered by me have been printed in these Publications. The work of remeasurement of the A pairs has been continued during the past year and a number of additional ones have been found to be in relatively rapid motion. A few of those in which the change is most decided are included in the following table, the columns of which give, in order, the star's number, the interval, in years, between the discovery measure and the later observation, the change in position angle, the distance at discovery, the change in distance and the magnitudes. Many other pairs show change in angle ranging from 5° to 15°, and in most cases this is due to the orbital motion; in some instances, doubtless, it may be due to errors of measure. In all, about 1,700 pairs have now been remeasured after an interval of from 8 to 17 years, and indications